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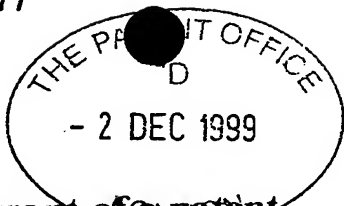
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COPYRIGHT PROTECTION SYSTEM AND METHOD

Field of the Invention

5 The present invention relates to a system and method for copy-control of digital content carried on a data carrier such as a compact disc. The system provides copyright protection by restricting the copying of digitally represented matter, principally but not exclusively digital audio, whilst providing access controls which enable authorised extraction and usage of the digital data.

10

Background to the Invention

A persistent problem in the field of consumer audio has been the difficulty of providing practical support for the legal protection offered by copyright law for
15 products of the recording industry. This practical difficulty arises because products of the recording industry are widely distributed on carriers such as CD which carriers have found widespread use in other industries such as the computer and IT industries.

Copyright Protection

20

Copyright protection systems such as the serial copy management system (SCMS) agreed between the recording industry and the consumer electronics (CE) industry, have worked well for those industries. However the computer and IT industries have developed products which whilst not adhering to copyright protection systems such as
25 SCMS, do incorporate the functionality of audio playing and copying equipment. There is thus a general need for a new copy-protection system specific to the products of the recording industry, which system provides copy-protection against general purpose equipment which services generic copying of data.

Compatibility with Current Equipment and Standards

30

One proposed solution lies in the development of entirely new data carriers and new equipment including players and copying devices, which carriers and equipment incorporate new copy-protection standards. An example is the development of DVD-

adhere to the Red Book standard for CD-Audio. Such non-compliance with the Red Book may be used to produce a copy-protected audio CD which protection does not prevent the audio CD from being played in a standard CD player but which protection disrupts the digital data-extraction process by which audio data is copied from its original carrier, typically a CD, to a second carrier, typically a computer memory, a computer disk drive, or a CD-R disc.

There are many potential methods to achieve the protection of an original CD against extraction of data using CD and CD-R equipment installed in a computer. Such methods may be broadly categorised into three categories as follows: (1) Methods which employ manipulation of the disc table of contents (TOC). For example the starting address of the lead-out may be deliberately written incorrectly in the TOC, much in advance of the actual starting address of the lead-out – thus preventing normal playing of the disc using PC based CD players which are often programmed to prevent access to data on the disc beyond the starting address of the lead-out; (2) Protection methods which place data-structures on an audio CD which structures are intended to cause any PC based player to process the disc as a CD-ROM or as a multi-session disc. For example a short computer program may be inserted prior to the audio program area, which computer program will be executed by a PC into which the disc is inserted and where the program execution is intended to disrupt or prevent the extraction of audio data using computer-based CD or CD-R equipment. The program data may be 'hidden' with respect to audio play operations by placing the data in an 'extended pre-gap' on the disc; (3) Methods which manipulate the Red Book encoding standards in order to hinder digital data-extraction from the disc. For example the Red Book describes features of the CD encoding method by which time and index data are encoded in the 'sub-code channels'. This time and point information facilitates, among other things, the digital data-extraction of blocks of audio data from the disc, but which information itself is of limited use in playing the disc in a standard CD player. If the time and point information are written to the CD in certain ways which deliberately contravene the Red Book standard, then this may prevent accurate seeking of data blocks and frames during the extraction of digital audio data such that there will be errors in the extracted data which will cause audible artefacts upon playing the extracted data. However as noted the time and point

industries to provide generic tools, and the legitimate requirement of the recording industry to provide practical protection against infringing use of its products.

To avoid inconvenience to the consumer and to established markets, this new data-storage system may utilise the current standards for data carriers, but augment these standards with data structures which provide:

- Compatibility with installed audio player hardware
- Copy-protection for products of the recording industry
- Ability to extract digital audio data for authorised usage by compliant systems

Statement of the Invention

According to a first aspect of the present invention, there is provided a data-storage system comprising a physical carrier such as a CD which carries a first content file of data, the first content file being protected by a copy-protection system which restricts access to the first content by causing data-errors to be introduced into data extracted from the carrier, the data-storage system providing controlled access to the first content file by providing a second content file of data which is used to correct data-errors in the data extracted from the first content file.

It shall be understood that the term 'content file' is intended to cover terms such as 'content', 'data' and 'content file or data' and in particular, but not exclusively, applies to recording-industry content such as audio data or audio data in combination with additional data including text, graphics, software or video data.

It shall be understood that the term 'data carrier' is intended to cover any physical media used to carry any content file of data particularly, but not exclusively, optical disc media including CD, CD-R, DVD-Audio and MiniDisc.

file, audible artefacts were observable where the artefacts were not observable in the first content file, these artefacts shall be substantially inaudible in the repaired copy of the first content file.

5 According to the present invention, is provided a means of access to the second file of data through a controlled access system, such that whereas access to the second content file is required in order to access any content file equivalent to the first content file, then the first content file is effectively the subject of the access control system. Thus copying of the first content file to the second carrier may be controlled
10 by the access control system on the basis, for example, of whether the copying process is determined to be authorised and whether the second data carrier is determined to comply with requirements specified under the terms of an authorised copying process. Preferably, access to the second content file is protected by a system of encryption with controlled access to decryption keys. Advantageously the second
15 content file will be carried on a carrier using an encoding method to which itself is the subject of access controls, for example under the terms of a license governing usage criteria associated with the encoding method and governing any related extraction and decoding method.

20 It shall be understood that the second carrier may be any physical medium including, but not limited to CD-R, CD-RW, DVD-RAM, any computer memory system including RAM, Flash Memory, any disc storage system, and further the second carrier may be a virtual-memory system such as a paged memory or cache memory which virtual-memory is implemented using a physical medium.

25

According to a second aspect of the present invention, there is provided a copy-protection system with access controls which uses a data-storage system comprising a first physical carrier such as a CD and a first content file of data carried by the first data carrier, the first content file being protected by a copy-protection system which
30 restricts access to the content by causing data-errors to be introduced into data extracted from the first carrier, the data-storage system providing controlled access to the content by providing a second content file of information which is used to correct data-errors in the data extracted from the first content file.

which carries a first content file and which carries a second content file for the purpose of repairing a degraded copy of the first content file. This invention also extends to any second content file on any carrier which file is provided for the purpose of repairing any copy of a first content file which first file might be degraded as a consequence of being copied. This invention also extends to any carrier which carries a second content file which file may be used to repair a degraded copy of a first content file. This invention also extends to any file of data stored on any carrier, which data has been produced as a result of repairing a degraded copy of a first content file using a second content file. This invention also extends to any carrier which carries a content file which content file has been produced as a product of the process of repairing a degraded copy of a first content file using a second content file. This invention also extends to any method and process for preparing a second content file for the purposes of repairing a degraded copy of a first content file. This invention also extends to any process or method or apparatus or equipment by which a degraded copy of a first content file may be repaired using any second content file, whether a physical apparatus or a computer program or process which implements the function of that apparatus. This invention also extends to any tools for example glass-masters, produced directly for the purpose of manufacturing an embodiment of data-storage systems or copy-protection systems according to this patent, including intermediate tools for example mothers and stampers required at intermediate stages in the production of CDs, which tools or intermediate tools are used for the purpose of manufacturing an embodiment of data-storage systems or copy-protection systems according to this patent.

Brief Description of Drawings

A specific embodiment of the present invention will now be described by way of example only with reference to the accompanying drawings, in which:

Figure 1 schematically illustrates a data-access system comprising a data-carrier 1, carrying a content file 2 which is accessible by playing the carrier disc in an audio player but which, upon extracting a digital copy of the content yields a degraded file 3 containing data-errors, but which carrier also yields through an access control system

CD is played in an audio CD player, but which will disrupt the digital extraction of data from that CD using a PC based CD-ROM drive. As is known in the art, such a copy-protection technique will thus protect against digital data extraction using PC equipment and therefore protect against the production of infringing copies of the original CD using a CD-R recorder. A problem is that it will therefore not be possible to extract data from the protected CD for legitimate purposes such as for playing in an SDMI portable device player. According to the present embodiment, a second content file of data is encoded into the subcode channel and recorded by the LBR onto the glass master. It will be understood by a reader skilled in the art, that there are many possible methods of interest for encoding at least one second content file into the data recorded onto the glass master for example by manipulating the bits of the lead-in, lead-out, the merging bits, or any of the eight subcode channels. For the purposes of illustrating the present embodiment only, a specific example is presented where 98 bits of PCM audio data are written in the R subcode channel of each frame of the program area to provide an auxiliary channel giving 7350 bits per second. It will be appreciated that many alternative solutions are possible according to the present invention. This second content file contains extracts of data copied from the portions of the first content file corresponding to those portions of the first content file at which the absolute time is recorded non-monotonically on the glass master. The second content file is encoded in the subcode channel in locations which correspond to areas on the glass master at which the absolute time is recorded monotonically. Thus a CD produced from this glass master will play normally in the majority of audio CD players which do not refer to the absolute time data encoded in the subcode channel during normal play operation. Upon extracting digital data from the disc using the majority of PC based CD-ROM drive there will be errors in the extracted data corresponding to those points at which the absolute time was recorded non-monotonically. However in the present embodiment, by extracting the corresponding portions of the first content file which were provided in the second content file encoded in the sub-code channel, the errors in the extracted data may be repaired to provide a substantially error-free copy of the first content file.

Preferably, the number of points at which the absolute time is recorded non-monotonically is sufficiently few in number that there is sufficient storage capacity in

A further embodiment of the present invention is provided where the second content file contains data characterising the degradations which the first content file would suffer upon extraction, and which second content file data may be used to compute repair data or procedures which would be required in order to repair a degraded copy
5 of the first content file.

A yet further embodiment of present invention provides a data storage system where a degraded copy of the first content file is stored on an intermediate carrier such as a CD, flash memory, cache memory or in particular a web server or web cache, and the
10 second content file of data is stored on a separate carrier such as a smart-card or a web server, such that the second content file is the subject of a secure access control system, whilst degraded copy of the first content file is held on a high-capacity storage system which may be held locally or available remotely over a wide-bandwidth connection. Such an embodiment is of interest in e-commerce systems
15 which are required to protect content files on a server or cache and to provide access to that content under the terms of a transaction. The present embodiment supports this process by providing access to a degraded or partially incomplete copy of a first data file on a publically accessible web-server or web-cache whilst providing controlled access to a second file of data which is required in order to yield a complete copy of
20 the first content file. It will be appreciated by those skilled in the art that benefits in terms of efficient caching of large content files, and reduced encryption overheads, and limited preview models, are all facilitated by this embodiment.

25 CLAIMS

1. A data-storage medium comprising at least two data storage files, the first data file comprising data content with degraded data portions, said data medium also comprising at least one second data file, said second data file comprising data
30 corresponding to the degraded portions of said first data file, said second data file being usable to correct the degraded portions of said first data file.
2. A data-storage medium as claimed in 1, wherein said data system comprises a second data file containing checksum or CRC data for the purpose of detecting

portions of said first data file for the purpose of providing access to a non-degraded equivalent of said first data file.

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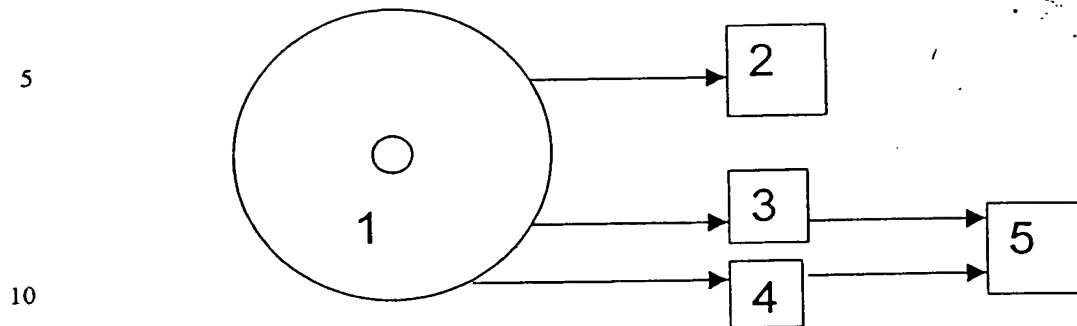


Figure 1

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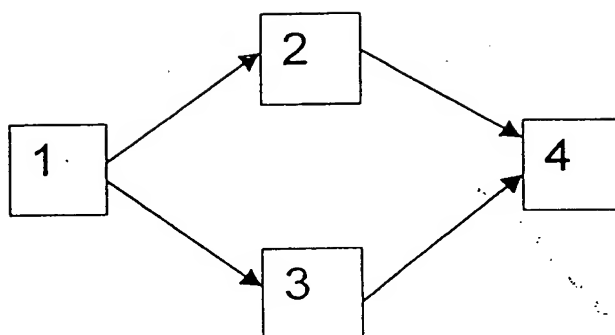


Figure 2